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DEPARTMENT OF LANDS AND FORESTS

HON. JULES ALLARD, Minister, ELZÉAR MIVILLE-DECHÊNE, Deputy-Minister

WATER POWERS

— OF THE —

Province of Quebec

— BY —

ARTHUR AMOS

Chief Engineer Hydraulic Service

Translated from the French

SEAWAY
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QUEBEC

1917

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PROPERTY OF LAKEHEAD UNIVERSITY

HYDRAULIC SERVICE
DEPARTMENT OF LANDS AND FORESTS
Quebec, Canada.

Montmorency Falls

INTRODUCTION

This memorandum was written for the purpose of giving the "Dominions Royal Commission," which sat in Quebec in November 1916, a general idea of the importance of the water powers of the province and of their remarkable location throughout its extent.

In order that the subject might be dealt with briefly and yet broadly and clearly, it was necessary to omit mentioning many small rivers and other details, but the interested reader who may wish to have additional information, can, in some cases, do so, by writing to the Minister of Lands and Forest of the province of Quebec, at Quebec, specifying the rivers in which he is interested.

Since going to press, a census of the hydraulic plants of the Province of Quebec has revealed the fact that the total capacity of these plants exceeds 825,000 horse-power.

THE WATER POWERS OF THE PROVINCE OF QUEBEC.

In order to give a general and comprehensive idea of the water power resources of the province of Quebec, its territory will be here divided into seven great sections, each embodying several subsections, which, in turn, will deal with the rivers which are of the greatest importance by their water-falls or the mills erected on them.

Before mentioning these divisions, it may however be necessary—so as to better understand the reason of their selection—to briefly describe the relief of the country and to show how to a certain extent, agglomerations of population have affected the utilization of the falls.

Notwithstanding the vast area of territory north of the river St. Lawrence, most of the water-falls hitherto developed or which are likely to be so within a fairly near period, are situate at comparatively slight distances from this river. The reason is that the Laurentian plateau extending along its north shore and a parallel chain of hills on the south shore constitute the main reliefs of that region and are the cause of the broken slope of the streams tributary to the main river and, consequently, of the water powers which the latter contain.

The chain of hills on the south shore,—a prolongation of the American Appalachian mountains,—runs from the 45th parallel of north latitude and the frontier of Maine to the extremity of the Gaspé peninsula. The comparatively narrow width of the latter, divided into two slopes throughout almost all its length by the crest of the mountains just mentioned, at once leads one to infer that the rivers flowing from them and, consequently, the water powers, can be comparatively but of slight volume and only of secondary importance.

Let us now return to the western end of the province, to the north of the St-Lawrence and of the Ottawa. There, the land may be divided into two main slopes falling northwards and southwards respectively, whose summit level may be said to be approximately in the vicinity of the National Transcontinental Railway.

On the southern slope, the waters gradually flow through a great many lakes towards the Ottawa river. To the north, they flow to James Bay through a region only slightly explored as yet.

The mean altitude of the height of land from the North Coast to this vicinity reaches from 1,500 to 2,000 feet. It is even lower than that (about 1,000 feet) in the north-western region.

Owing to this geographical configuration, to the innumerable lakes scattered through the southern slope of the Laurentian mountains and to the forests still spreading beyond the narrow inhabited strip along the banks of the St-Lawrence, the regimen of the waters is fairly regular. It is however necessary that there be no misunderstanding on the meaning of this expression. It may be stated that there are no torrents, in the strict definition of the word; but most of the rivers—except the St-Lawrence—vary, nevertheless, in their flow, and some, considerably. For instance this variation may be in the proportion of from 1 to 10 or again from 1 to 20, and even more. The winter flow is generally the weaker; the spring one, corresponding to the melting of the snows, is the stronger. The same rivers also reach their lowest level at the end of the summer, but the flow at that period remains, nevertheless, a little higher than the winter one.

As a rule, the height of the falls is not very great. To get a head of a hundred, of sixty, or even forty feet, rapids have often to be concentrated by means of dams or else diversions have to be made by means of penstocks or conduits.

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A few words should now be said about meteorology, since the knowledge of atmospheric precipitations is one of the important factors in calculating water powers.

Meteorology.—As a general rule, it may be said that the climate of Quebec—at least in such settled districts where continuous observations have been carried on—is markedly uniform: fine and warm summers, dry and rather cold winters.

If a little more precision were required, the country might be divided into four sections, in accordance with the data of the Meteorological Service, namely :

1.—The Lower St-Lawrence region.
2.—The Middle St-Lawrence region.
3.—The Lake St-John region.
4.—The North-West region. (1)

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(1) Statistical Year Book.

The mean temperature of the first region varies between 10°F in mid-January, to nearly 60°F in mid-July. The proximity of the sea tends to diminish the cold as well as the heat at the maximum periods.

In the second region, the Middle St-Lawrence,—the sea influence is less felt and that of the plains and low-lying lands of the St-Lawrence, more. The curve of mean temperatures drops to 10°F in January and February as in the first but rises to nearly 68°F about mid-July.

The third region, that of Lake St-John, presents greater variations than the two foregoing ones, in both directions. This is due, in the first place, to its higher latitude and, consequently, to a proportional decrease of sunlight in the winter season; then, in the second place, to the atmospheric currents from the north which are less intercepted than in the St-Lawrence valley. The curve of that district drops to 0°F in January and rises to 65°F in July.

The fourth region, the North-West of the province, much resembles that of Lake St-John; its thermal variation is greater than in the St-Lawrence valley; the lower inflexion of its curve touches 0°F in January and the upper one, about 64°F in July.

Rain and snow.—Atmospheric precipitation also varies markedly in the various regions of the province. However, the observation stations are not as numerous as they should be, and the data are consequently somewhat vague.

In the Lower St-Lawrence region, the mean rain-fall is given as 32 inches per annum.

In the Middle St-Lawrence region, the mean rises to nearly 37 inches; near Quebec and Montreal especially, the precipitation even exceeds 40 inches.

The Lake St-John region is less rainy, the mean dropping to 26.6 inches per annum.

Lastly, in the North-West district, the mean is 29.7 inches, with a tendency to be lower by one or two inches in the basin of lake Abitibi.

It may also be added that atmospheric precipitations, rain or snow, are fairly evenly distributed throughout the year; in order words, there are not as in other countries, completely dry seasons followed by very rainy ones.

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After these few remarks on the physical aspect of the country, the divisions of our study will now be dealt with. Beginning with the Gulf

of St-Lawrence, that is, to the east, and with the south shore, the following groups are found:

South Shore:—

I. The Gaspé peninsula, from the Baie-des-Chaleurs to the Chaudière river, that is to the vicinity of the city of Quebec.

II. From the Chaudière river, near Quebec, to the American frontier or the 45th parallel of north latitude.

North Shore:—

III. The North shore of the St-Lawrence, from the Strait of Belle-Isle to the Saguenay river.

IV. From the Saguenay to lake Temiscamingue or to the Ontario boundary.

V. The Lake St-John region.

VI. The Abitibi region adjoining the Transcontinental railway.

VII.—The James Bay basin and Ungava or New Quebec.

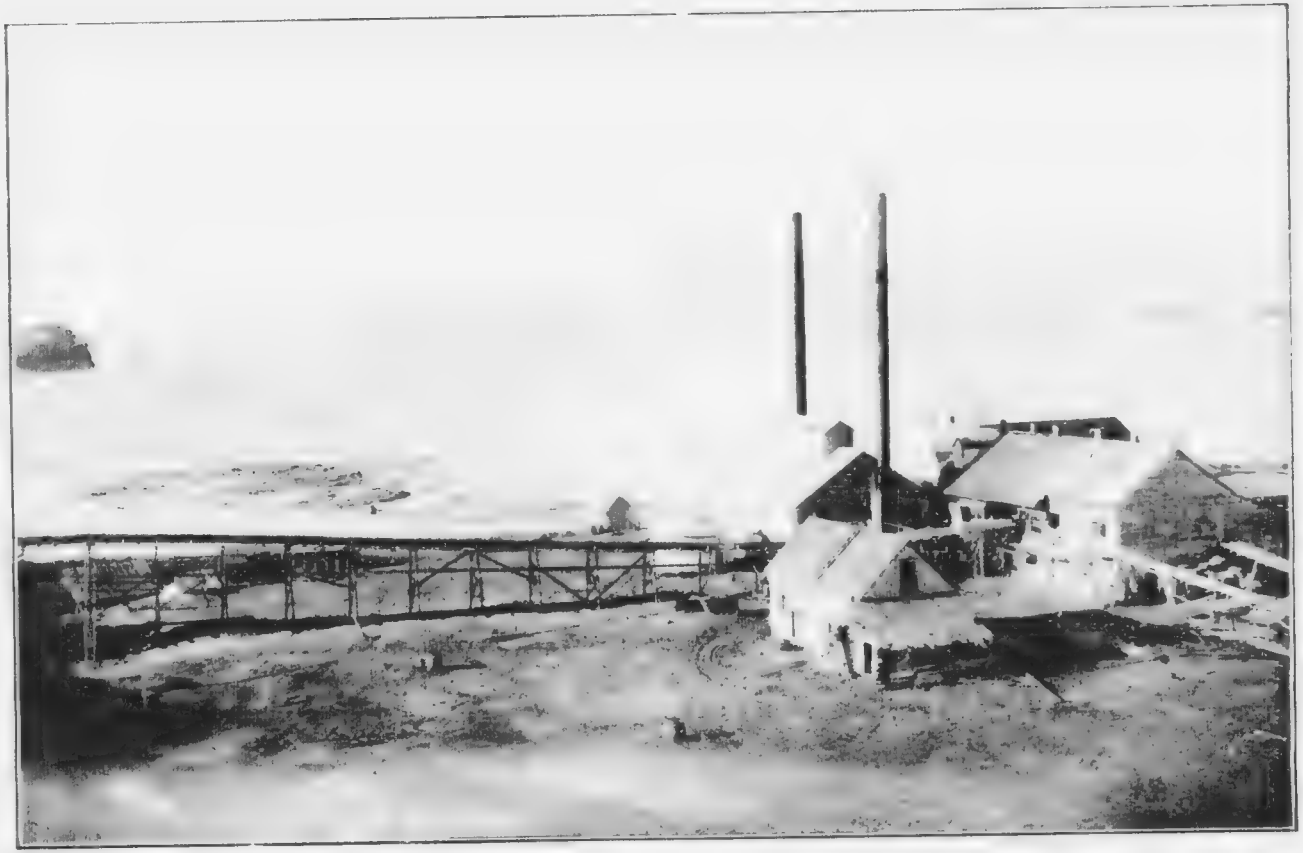
I

THE GASPÉ PENINSULA

FROM THE BAY OF CHALEURS TO THE CHAUDIÈRE RIVER, NEAR QUEBEC.

The Gaspesian watershed follows a general direction approximately parallel to the shore. Starting from the neighborhood of lake Matapedia where rises the river of that name which forms the western boundary of the peninsula, the summit level divides the two slopes into unequal portions: that on the south descends towards the Bay of Chaleurs and is the greater. The northern slope is at least twice smaller. As a result, the rivers flowing towards the Bay of Chaleurs have a greater flow than those running towards the St-Lawrence.

Rivers Matapedia, Grande-Cascapedia, Petite-Cascapedia, Bonaventure, Saint-John, York, Dartmouth.— The principal rivers on which the water powers have attracted attention are : the Matapedia (whose watershed is about 1,500 square miles), which falls into the Bay of Chaleurs at is very head; the Grande-Cascapedia (watershed, 1,040 square miles); the Petite-Cascapedia (watershed, 603 square miles); and the Bonaventure river (watershed, 650 squares miles). Then, towards the head of Gaspé Bay, the three rivers, Saint-John (watershed, 440 square miles); York (watershed, 525 square miles); Dartmouth (watershed, 318 square miles).



Dartmouth river, Gaspé

The first four are especially good for salmon fishing and have been used for that purpose for a long while. This has so far been a great obstacle to the development of the water powers. On the other hand, those rivers, at least in such parts as have been examined to any extent, do not seem to have falls of importance.

In the projects that have been submitted,a head of water had to be created by concentrating the rapids by means of dams. The grades of those streams have been rated to be from eight to fifteen feet to the mile; this figure we mention to give an idea of their profiles.

The opposition of the salmon fishermen has so far prevented any proper examination of the power possibilities on the Matapedia; but, on the Grande and Petite-Cascapedia, further progress has been made and investigations have been more thorough. Lots had been selected at "Jack the Sailor" rapids, on the Grande-Cascapedia, in particular, and it was expected that about 5,000 horse-power would be obtained there. Then on lot 19, range VII, of the Petite-Cascapedia, about an equal power; lastly, about 1,000 H.P. at the "Malin" rapids, on the Bonaventure river. These three were especially inspected and more details will be found in the official reports of the Department of Lands and Forests; but, in the end, all development projects miscarried owing to the conditions imposed by the fishermen for protecting the salmon.

As to the three other rivers falling into Gaspé Bay, at its head, there are no accurate data, and it can only be said that the people of the locality have shown an interest in the matter, and that it is probable that some of their falls or rapids can be utilized. However, the salmon-fishing question arises there also.

Ascending the south shore of the Gulf of St-Lawrence, the second slope of the Gaspé peninsula is now reached. As already stated, the width of that slope is slight, say about from twenty to thirty miles; it follows that the rivers, there are of comparatively small importance, the flow being, as a rule, a function of the watershed.

River Madeleine.— The first river of any interest is the Madeleine watershed, 520 square miles). The water powers of that river within the portion of its course, outside of the seigniory of La Madeleine, were granted,in 1902, to an American who has done no development work since then. However, a project is now under consideration for the building of a pulp and paper mill with an estimated power of 7,000 H.P. The Department of Lands and Forests is negotiating an agreement between him and the owners of neighbouring timber limits.

River Cap-Chate. The next river is the Cap-Chate and there has been, for some time, a question of putting up a large mill on it. The power expected to be produced by a dam giving a head of 80 feet, is 950 H.P.

River Métis. -One has now to go up to the Métis river to find falls of any importance, but the river is private property and has not been studied by the Government.

It should be stated here that seigniories conceded under the old regime, comprise the bed of the rivers running through them when their streams cannot be considered as navigable or floatable. In such cases, the water powers are private property and the Government has no special interest in ascertaining their water powers.

From this Métis river, westward, we now have a series of seigniories extending as far as Quebec. As a rule, the rivers watering that region are not very large owing to their limited basins and the water powers are subject to marked decrease, especially during the winter season. They are used however for industries which need not be in continual operation.

Grande-Cascapédia river.

Rivers du Bic, Trois-Pistoles, Du Loup. The Bic, Trois-Pistoles and Du Loup rivers may be mentioned in passing as having certain water powers of some interest. On the last named, especially, regulating reservoirs have been built which allow of the growing demand for continuous power, especially at Fraserville, being met.

Still proceeding up the St. Lawrence, one has to go more than one hundred miles before meeting a river of any importance. Opposite the island of Orleans, it may be observed that the watershed trends towards

the south thereby widening the riparian plain. The basins of the rivers then widen proportionately, and the Etchemin, near Levis, is the first to benefit of this ch[illegible]

River Etchemin. That river, with a basin of 550 square miles, is [illegible] nor floatable and, like the foregoing ones, runs through the region of seigniories where the Government has no rights.

Various mi[illegible] falls. [illegible] a somewhat torrential character.

We now [illegible] division beginning with the Chaudière river.

II

FROM THE CHAUDIÈRE RIVER, NEAR QUEBEC, TO THE AMERICAN FRONTIER.

River Chaudière. The Chaudière falls into the St. Lawrence about seven miles above Levis. Its length, from its source in Lake Megantic, is 112 miles. The area of its basin is 2,580 square miles. The altitude of its source is about 1,300 feet above its mouth.

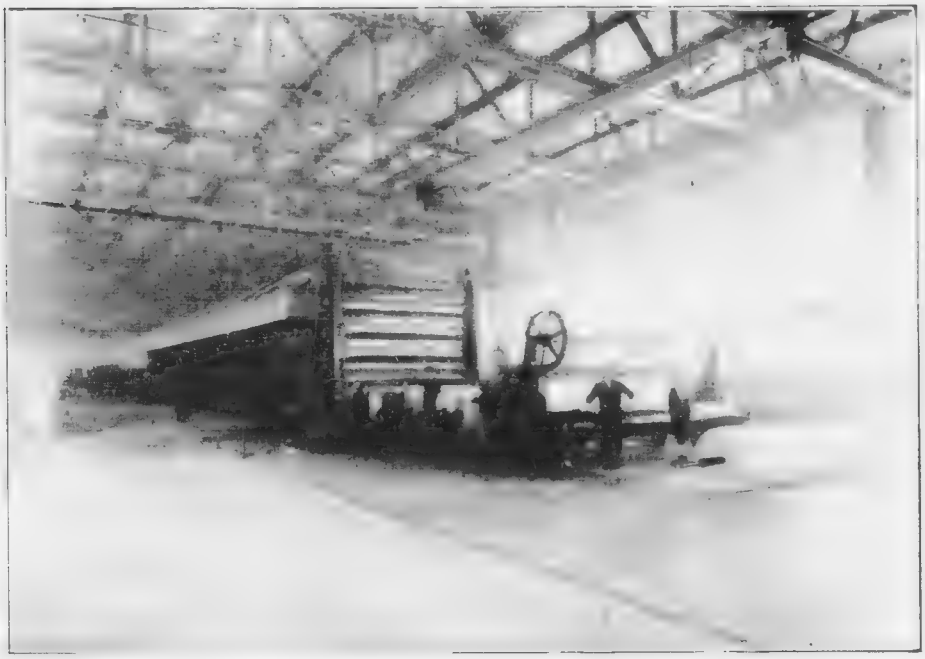
There are many rapids in it, but only few important falls. One of the latter is situated at the so-called "Chaudière Curve," not far from its mouth, its height is 114 feet.

There are several flourishing establishments along its course; among others, a pulpmill and many saw-mills. Lastly, there is a hydro-electric plant (that of the "Canadian Electric Light Co.") using the falls at Chaudière Curve, installed for a production of 2,500 K. W., but the power may drop to 400 K. W. when the water is very low. That plant supplies power to the Levis and Quebec tramways.

The regimen of this river is of a torrential character. The melting of the snow in the spring causes serious inundations. The Government has begun studies with a view of regulating its flow, but such studies are not far advanced. Regular gaugings (not extending over many years) however, have enabled it to be ascertained that the flow dropped to about 0.42 cubic feet per second per square mile, in the month of July. As regards flood waters and freshets, there are no definite figures, but some engineers have estimated them at over 40 feet per second per square mile, which means that the proportion of the variation would be 1 to 280, but these figures must be taken with reservation.

There are several suitable sites for power plants where heads up to fifty feet can be obtained. This river waters a very fertile region and one

Bromptonville, on the Saint-François river.



Interior view of the Brompton Pulp & Paper Co's paper mills, on the Saint-François.

of the oldest settled districts of the province. It is probable that the storage of the flood waters might, by diminishing the danger of inundations, tend to promote the development of the water powers. That problem is under consideration.

The question of ownership of the bed of this river has, so far, hindered the development of its water powers. This question will be dealt with in the concluding chapter of this study.

River Bécancour. Continuing up the St-Lawrence, the Bécancour and Nicolet rivers may be mentioned. Their flow is very small at certain seasons. The Maddington falls, on the Bécancour, have been the object of special investigations; their average capacity is estimated at 4,000 H.P., and their minimum at 925 H.P.

River Saint-François. The area of the basin of this river is about 3,930 square miles, 556 of which are beyond the frontier and extend into the territory of the United-States. It is one of the twelve most important tributaries of the St-Lawrence in the province. Its length is about 140 miles, counting from the western extremity of the lake of the same name, where it rises. The altitude of the lake above the mouth of the river is about 950 feet, giving an average declivity of 6.4 feet per mile. The discharge of this river varies considerably. The spring freshets, though less considerable than on the Chaudière, nevertheless cause serious damage, especially between Sherbrooke and Richmond. There are several hydraulic plants along its course, namely:

At D'Israeli	Hydro-electric plant	40 feet head	4,300 HP
At "	Saw-mill	20 " "	
At Weedon	Hydro-electric plant	31 " "	1,000 HP.
At East Angus	Pulp-mill	55 " "	10,400 HP.
At Bromptonville	Pulp-mill	35 " "	10,100 HP.
At Windsor	Paper mill	16 " "	5,025 HP.
At Drummondville	Hydro-electric plant	12 " "	2,400 HP.

Other falls and rapids have been granted by lease, namely: at Drummondville, at Hemming Falls and at the Spicer rapids; they are not yet developed.

At the grantees' request, the Provincial Government has had a storage dam built which regulates the flow to 600 cubic feet per second, and this will allow the total power of the various plants already established there, being increased by 6,090 H.P.-year. There is a question of furnishing such additional power to the mill owners at the rate of $7.50 per H.P.-year.

Brompton Pulp & Paper Co's plant, at East Angus, on the Saint-François river.

Plant of the Canada Paper Co., Ltd. at Windsor, on the Saint-François.

Leaving aside the still undeveloped falls, the Department will receive from this source a revenue sufficient to pay the interest and sinking fund on the cost of construction of the lake St-François reservoir.

The capacity of that reservoir is 438 square-mile-feet, that is to say equal to an area of 438 square miles covered by a depth of water of one foot, or twelve billion cubic feet.

River Magog. There are also several hydraulic plants on the Magog the largest tributary of the St-Francois. They supply electricity to the city of Sherbrooke for light tramways, water works pumps and various industries. The water from the St-François reservoir does not run however through this river.

River Yamaska. This rather important tributary of the St-Lawrence falls into it, not far from the foregoing one. Its basin is 1914 square miles; its regimen if of a torrential character due, partly, to the excessive deforestation carried on for farming land. The small mill-along its course have to shut down at times, although an attempt has been made to regulate its flow by building a storage dam at Farnham. We have no accurate data regarding its regimen.

River Richelieu. One of the great tributaries of the St-Lawrence in the province. Its basin is about 9,200 square miles, 7,750 of which are in the United States and 1,450 in Quebec.

This river is navigable and an extensive trade is carried on by its means with the neighbouring country. There is a large hydro-electric plant at Chambly whose owners (The Montreal Light, Heat & Power Co.) have acquired the bed of the river from their power-house to eight miles above it. The energy developed is about 20,000 H.P.

This ends the list of the main tributaries on the right bank of the St-Lawrence. Some small water-power mills may be found, it is true on other smaller tributaries, but they are of secondary interest only and may be omitted here.

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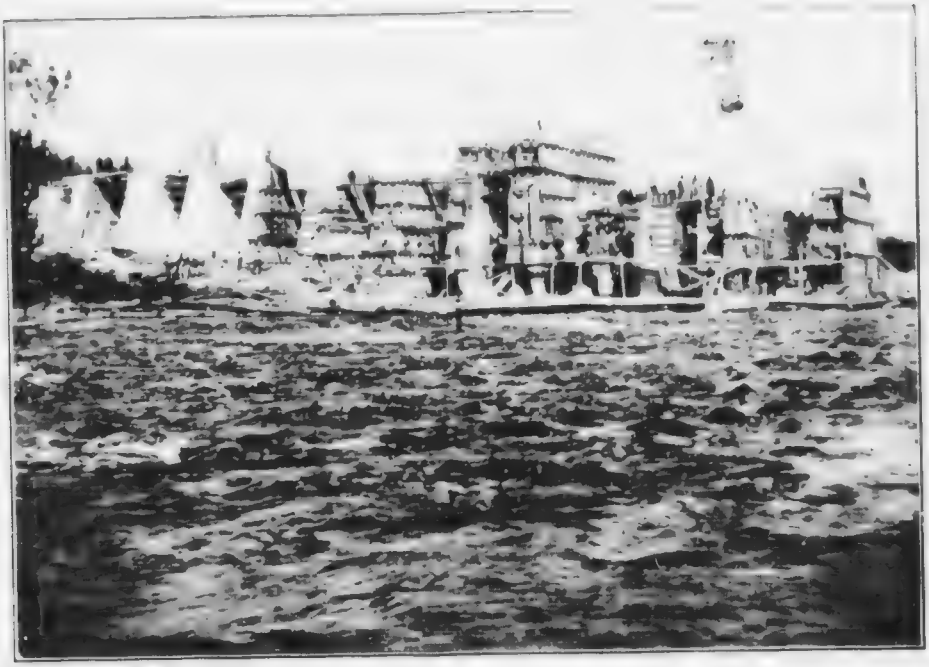
Before passing to the other bank of the St-Lawrence, a few words should now be said about the great water-powers of that river itself.

River St-Lawrence. The difference of level between the expansion of the St-Lawrence known as Lake St-Francis and the harbour of Montreal is 130 feet in round numbers; it is divided into two great sections of rapids: one runs from lake St-Francis to the head of lake St-Louis, another expansion of the river; the other, from the foot of lake St-Louis to Montreal. The variations in the flow of the St-Lawrence, all proportions considered, are comparatively slight, (approximately 1 to 2); such remarkable uniformity being due to the natural reservoirs formed



Storage dam on lake Saint-François, under construction (1917).

"La Loutre" storage dam, Upper Saint-Maurice river, under construction (1917).

by the great lakes; as a consequence it follows that the water-powers susceptible of development along it course are part [illegible] advantageous.

On account, however, of the conflicting interests of navigation as opposed to industrial diversion canals, and the fact that both the federal and provincial governments have water rights, power developments have been carried out only to a limited extent. Yet, when one recalls that the theoretical energy of the upper group of rapids is, for the 250,000 cubic feet of water per second that the river flows, over 2,000,000 h.p., and for the second group at least 700,000 h.p., assuming that 27 feet of the declivity may be utilized, it is obvious that before long a solution of the problem will have to be very earnestly studied by the two governments with the collaboration of interested parties.

Such an amount of energy lying so to say at the very doors of the metropolis, notwithstanding the great difficulties to be encountered in securing it, should not be allowed to go to waste permanently and should have an immense bearing on the future destiny of that district.

Already, several sites have been developed in that portion of the course of the St-Lawrence, namely:

The Valleyfield cotton mill;

The St-Timothée plant, using a diversion of the old Beauharnois canal and producing 20,000 H.P.;

The great hydro-electric works at Les Cèdres rapids, installed for producing 90,000 H.P., but which, when fully developed, will give 160,000 H.P.;

The more modest plant of the Provincial Light Co., using a diversion of the Soulanges canal;

Then, in the immediate vicinity of Montreal, the Lachine hydro-electric works, with a head of 15 feet, producing about 20,000 H.P.;

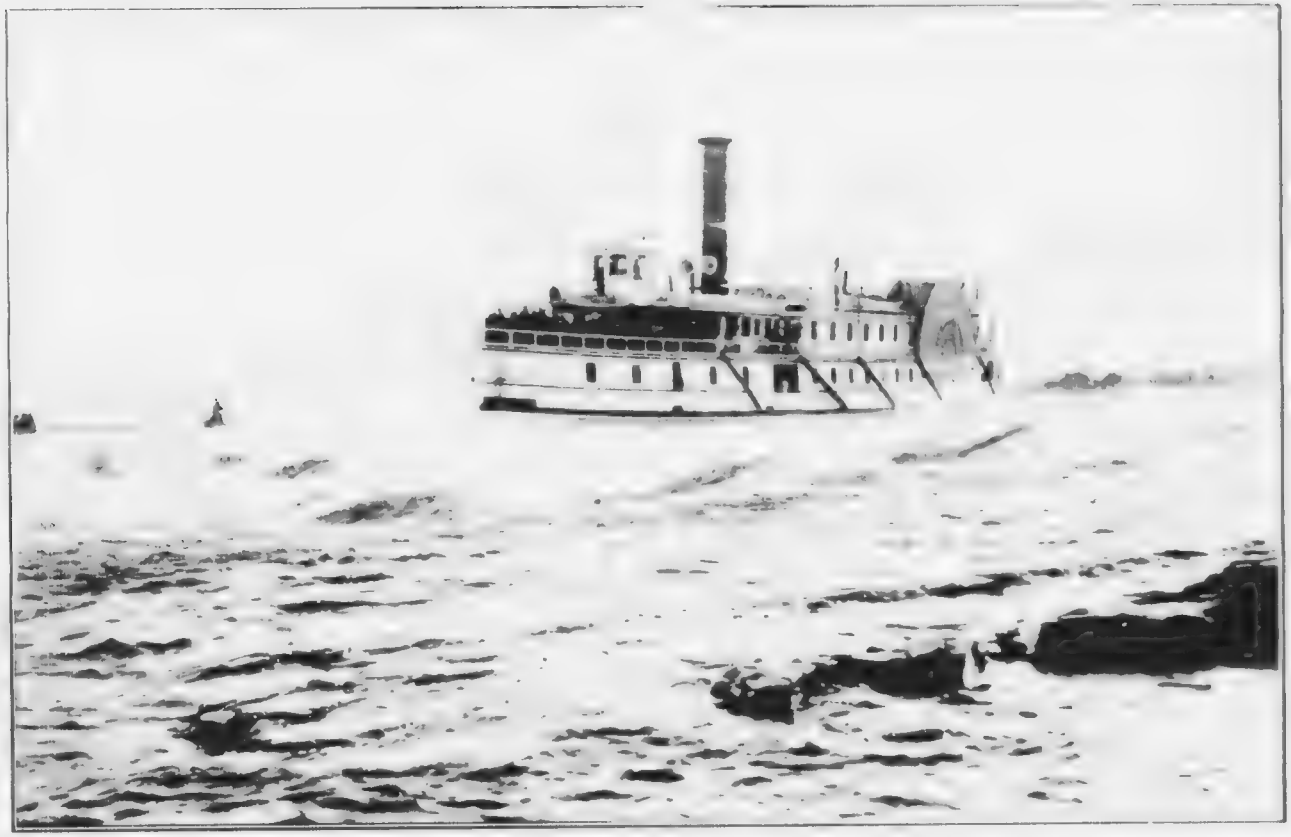
Lastly, several minor industries obtaining the water they require for their motors from the Lachine canal.

It may be added that another section of the Lachine rapids has been leased for some years, but has not yet been developed.

III

THE NORTH SHORE OF THE ST-LAWRENCE, FROM THE STRAIT OF BELLE-ISLE TO THE SAGUENAY.

The north shore of the river is characterized by the proximity of the Laurentian chain of mountains and by the innumerable islands, bays and creeks along the coast. That great extent of some six hundred miles in length is not very hospitable and is but sparsely populated.



Sault Saint Louis, near Lachine.

There are over fifty important tributaries of the St-Lawrence between the Esquimaux river and the Saguenay.

As a rule, it may be said that the regimen of those rivers has not been studied, with the exception of three or four, whose flow has been measured but only in an incomplete manner. As to the falls, many of them have been recorded by the surveyors who sealed the rivers in that region but the information so furnished is too vague to serve as a basis for development projects. Consequently, no sure emplacements for industrial installations can be advised or offered to the public, with the exception of those mentioned below. As matters stand at present, persons wishing to obtain water-powers there, are obliged to rely upon their own personal investigations.

Rivers Esquimaux St-Augustin, Petite-Mécatina, Natashquan, and Romaine. Several of the large rivers on the north shore have been surveyed over a considerable portion of their course, as for instance: the Esquimaux river to about 66 miles from the coast; the St-Augustin to 70 miles; the Petite-Mécatina to 25 miles; the Natashquan to about 150 miles; and the Romaine, to 170 miles. Those measurements enable to approximately establish the distance between the St-Lawrence and the dividing line of the watershed. The extreme points reached on those rivers are at altitudes varying from 900 feet above sea level for the St-Augustin river, to 1450 feet for the Natashquan, and nearly 3000 feet for the Romaine.

From the length of those rivers and the area of their basins, it may be inferred that their flow must be considerable and, consequently, that the many falls shown on the maps may furnish water-powers of great capacity some day. The fact, however, must not be overlooked that difficulty of communication, lack of population and the severity of the climate will be serious obstacles to the utilization of the resources of that region. Therefore, before any capital is expended there, the conditions of the districts best known and easier of access should be investigated such, for instance, as that of lake St-John or that of the Upper St-Maurice. But to avoid going any further into generalities, the few details known about some of the large falls of that region had better be stated.

River Manicouagan. This river is probably the most important one on the north shore. It is situated about 100 miles below the mouth of the Saguenay, or 225 miles from Quebec. Its basin is 15,000 square miles. It has been surveyed to beyond 250 miles from the coast. The altitude of its sources is estimated to be 2,000 feet. The first group of its falls, two miles from its mouth and of a total height of 86 feet has long been famous. Its flow at low water stage, at this point, is believed

Hydro-electric plant, on the Saint-Lawrence river, at Les Cedres rapids.

to be capable of producing 50,000 H.P. [illegible] basis for calculation. [illegible] falls [illegible] cancelling of the [illegible] under consideration.

River Aux Outardes. The [illegible] region. Its length [illegible] 200 miles; its resource [illegible] in water power [illegible] The first falls, near its mouth [illegible] himself to develop at least 7,000 H.P. [illegible] they can yield. In fact, the [illegible] 181 [illegible] winter flow is 2,800 cubic feet per second and which [illegible] capacity of 59,000 H.P. for that [illegible].

River Sault-au-Cochon. Some of the falls on the [illegible] of comparatively short extent (840 [illegible] miles) are leased; the grantee has [illegible] to develop 1,000 H.P. before 1917. He also owns a timber [illegible] utilised.

* * *

Various other concessions by Lower Saguenay [illegible] the foregoing ones may also be mentioned.

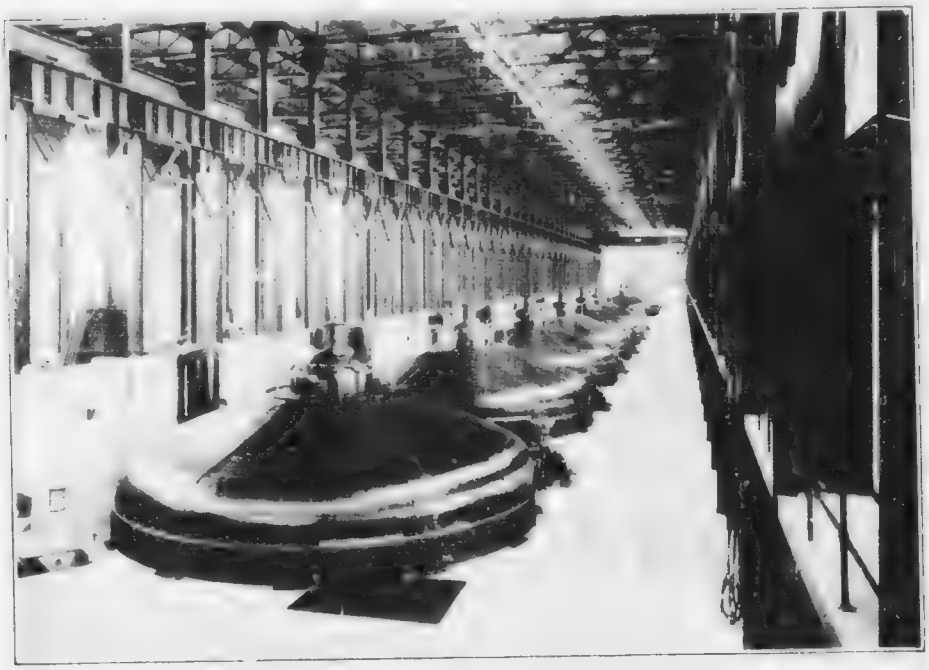
River Marguerite. A [illegible] industrial [illegible] in 1904 at the mouth of the river to Mr. [illegible] Clarke, of New York. A pulp mill with a capacity of from 100 to 200 [illegible] season, has been put up and there [illegible] village called Clarke City. The [illegible] in it about 1,200 square miles.

River Pentecôte. It [illegible] about 132 miles [illegible] the Saguenay and its basin is 1,000 [illegible] on the 10th February 1903 [illegible] 1,800 [illegible] mouth of the [illegible] and Riverin rivers. [illegible] 10,000 H.P. In 1910 an expenditure of $110,000.00 had been spent for a [illegible].

Rivers Grande-Trinité, Petite-Trinité, au Rocher, Calumet. A [illegible] of the [illegible] 1904 to an Ontario company. The [illegible] of energy that can be utilised is not known. The rivers are of the third order and are situated in the neighbourhood of Pointe-aux-Mères, about 260 miles from Quebec.

The Seigniory of Mingan. Lastly, may be mentioned the concession called "The Seigniory of Mingan," a strip bordering the St-Lawrence, six miles in depth by one hundred and fifty in length, extending from Cape Cormoran to the Aguanus river, north of the island of Anticosti. Its area is estimated at 955 square miles or 600,000 acres. Twenty-one rivers, some large important ones, run through it.

A few data respecting a certain number of falls on those rivers have been obtained. The water powers on them are the absolute property of the owner of the seigniory.



Hydro-electric generators, at Les Cèdres rapids.

IV

FROM THE MOUTH OF THE SAGUENAY TO LAKE TEMISCAMINGUE.

From the Saguenay to the neighbourhood of Quebec, the coast still retains the rugged aspect of the foregoing section, and the few rivers flowing from the mountains are subject to considerable variations in their flow. None of them, moreover, are of very great importance.

The following met with as one ascends the St-Lawrence, may be mentioned.

River Noire. This is a small stream with a basin of less than 300 square miles, there is a saw-mill in connection with lumbering operations near its mouth.

River Malbaie. —(Also called Murray river). A river with a very variable flow owing to its steep slope. Its basin is 795 square miles and extends back to the Laurentides National Park. It is studded with many lakes, the streams from which, over 35 in number, progressively add to the river's flow.

A pulp and paper mill of the first order is built some five miles from its mouth. A production of 100 tons of pulp per day had been counted upon, but, as the mill was put up without taking the very irregular flow of the river into account, the expected output has not been reached. The turbines work under a head of 60 feet.

With a thorough regulation of the flow, a capacity of from 5,000 to 6,000 H.P. might be obtained, but the present minimum energy probably does not exceed 3,000 H.P. The basin of this river is well wooded. The company operating the mill owns a timber limit of 390 square miles.

There are a great many other falls on this river, both within the bounds of the seigniory and in the park, but their development would be costly.

River Ste-Anne-de-Montmorency. Its basin is 432 square miles. Its flow is very variable, the proportion of the minimum to the maximum being from 1 to over 60. There are several interesting falls on it, particularly those of St-Joachim and those known as "The Seven Falls." The latter have recently begun to be exploited. The power plant is to have a capacity of 24,000 H.P. with a head of 410 feet, the highest in the province, we believe.

Nevertheless, to obtain the expected capacity, it will be necessary to have several reservoirs to regulate the flow. The Government intends to study this problem forthwith.

River Montmorency.—It falls into the St-Lawrence about six miles below Quebec. Its splendid vertical cascade, 268 feet high, is famous. It is, however, more picturesque than powerful. In fact, its basin is only 387 square miles and its flow is slight at low water stage. The capacity of the generators of the power-house built for utilizing the falls is 3,300 K.W. Two other power-houses are built on this river.

River Jacques-Cartier. This river like the three foregoing ones, rises in the National Park. Its drainage basin is 917 square miles. The regulation of its flow by erecting a storage dam on

Old hydraulic mill at Pont-Rouge, on the Jacques-Cartier river.

lake Jacques-Cartier, is under consideration. Several mills are built on this river. The principal one is that of the Donnacona Paper Co., near its mouth. The company is thinking of utilizing a second fall above the present mill.

Batiscan river.

At Donnacona, the company is the absolute owner of the site, as the Department has sold whatever rights it might have had.

Mention may also be made of the site of the former Jacques-Cartier Electric Company, which utilizes a fall 38 feet high, producing 1,500 K.W., the electric current is transmitted to Quebec. The energy produced drops 70 per cent in the month of March when the flow is at its minimum.

Lastly, there are many other falls on this river which would be rendered capable of development by means of the proposed dam.

River Ste-Anne-de-Portneuf. The St-Raymond Paper Company has an important establishment on this river, the site whereof was sold by the Government in 1906, as being suitable for the utilization of a capacity of 125 H.P.

There are various other falls on this river which might be utilizable, but they cannot be treated of here, owing to lack of space.

River Batiscan. A very interesting river, with a basin of 1,800 square miles, whose resources have so far been but very little utilized. It was the object of a detailed study by the undersigned which will be found on page 130 of the report of the Minister of Lands and Forests for the year 1913. This river would be eminently suitable for industries of modest importance requiring not more than from 500 to 1,000 H.P. There are many important lakes in the neighbourhood of its sources, but the study of their capacity as storage reservoirs has not yet been made.

River St-Maurice. It is the third in importance of the great tributaries of the St-Lawrence. Its length, counting its windings, is nearly 350 miles. Its minimum flow is stated as being 6,000 cubic feet per second at Shawinigan Falls, and its maximum, at high water stage, attains over 140,000 cubic feet per second. These figures give a variation of 1 to 23.

On this river, the greatest production of hydro-electric power in the province is carried on. The power produced there is transmitted to Montreal, Quebec, Trois-Rivières, and even across the St-Lawrence in Beauce and elsewhere.

The principal falls developed are: the Shawinigan (148 feet), 216,500 H.P.; and the Grand'Mère (83 feet), 120,000 H.P. The La Tuque falls, with a difference of level of 111 feet, are only partly utilized. Another project is under consideration for damming the river eight miles above Trois-Rivières at the place called "Les Forges"; where a capacity of from 15,000 to 20,000 H.P. is expected to be obtained.

The National Transcontinental Railway along the Saint Maurice River

Such is the importance of those establishments that the Government, to meet the demands of the manufacturers interested in the exploitation of the energy that river can furnish, has built the important dam of "La Loutre", owing to its proximity to the falls of that name on the Upper St-Maurice. That dam contains 68,000 cubic yards of masonry and is 234 miles from the mouth of the river. The artificial lake thereby created has an area of some 300 square miles and can store 160,000,000,000 of cubic feet of water. This volume will allow of the regulating of the flow at 12,000 cubic feet per second, at Shawinigan, and will thus enhance the value of a great many falls not yet utilized.

By means of those reservoirs, the surplus permanent energy which those power plants will have at their di-posal will be, in round numbers, for Shawinigan 32,000 H.P.; for Grand'Mère 16,000; and for La Tuque 19,000.

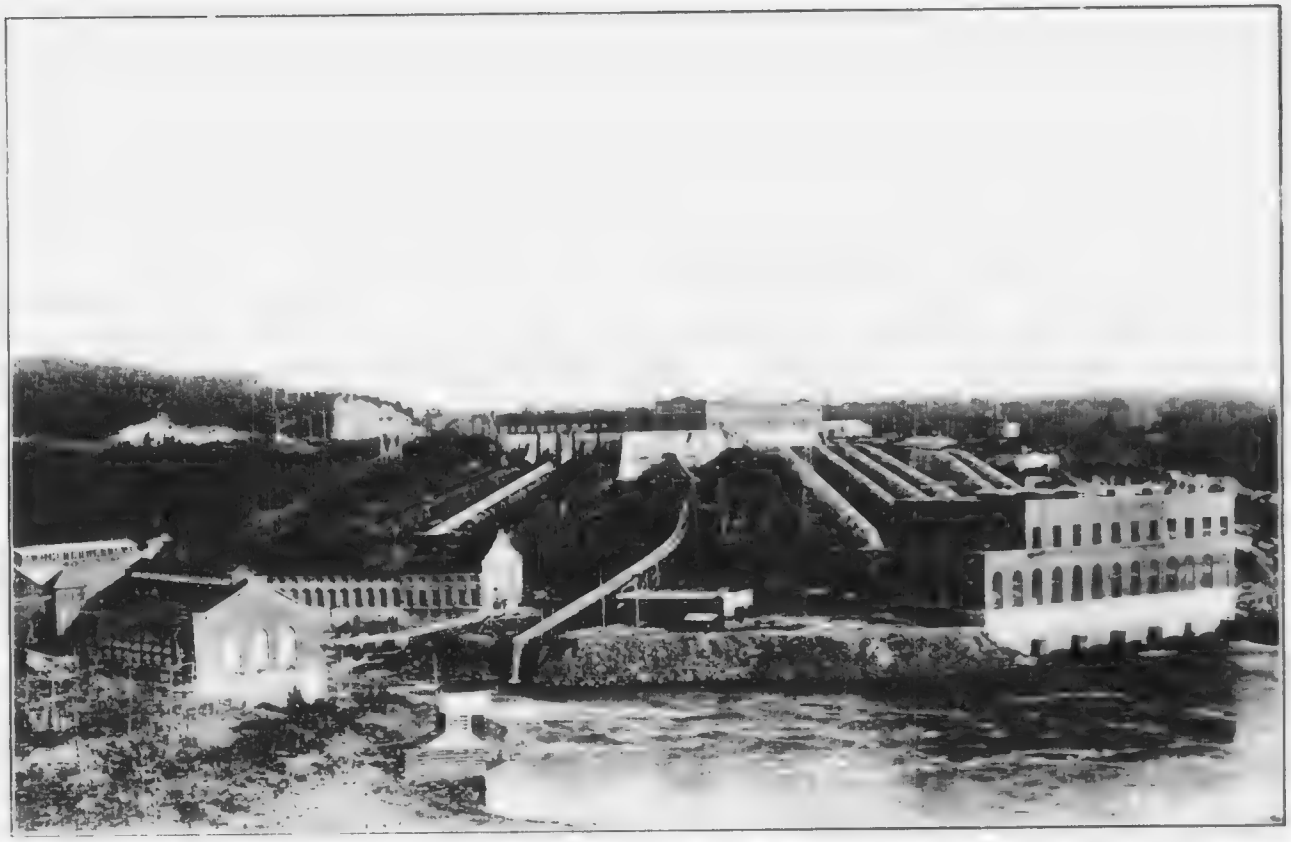
The water will be paid for by the companies at the rate of so much per horse-power-year. The cost of the dam reached $1,661,000.00, without the accessory works; and the revenues produced from the sale of the extra power to existing establishments alone will suffice to pay the interest and sinking fund of the capital. The dam was completed on schedule time, the 1st January 1918.

The height of the various falls on this river will be found on page 39 of the fourth report of the Quebec Streams Commission.

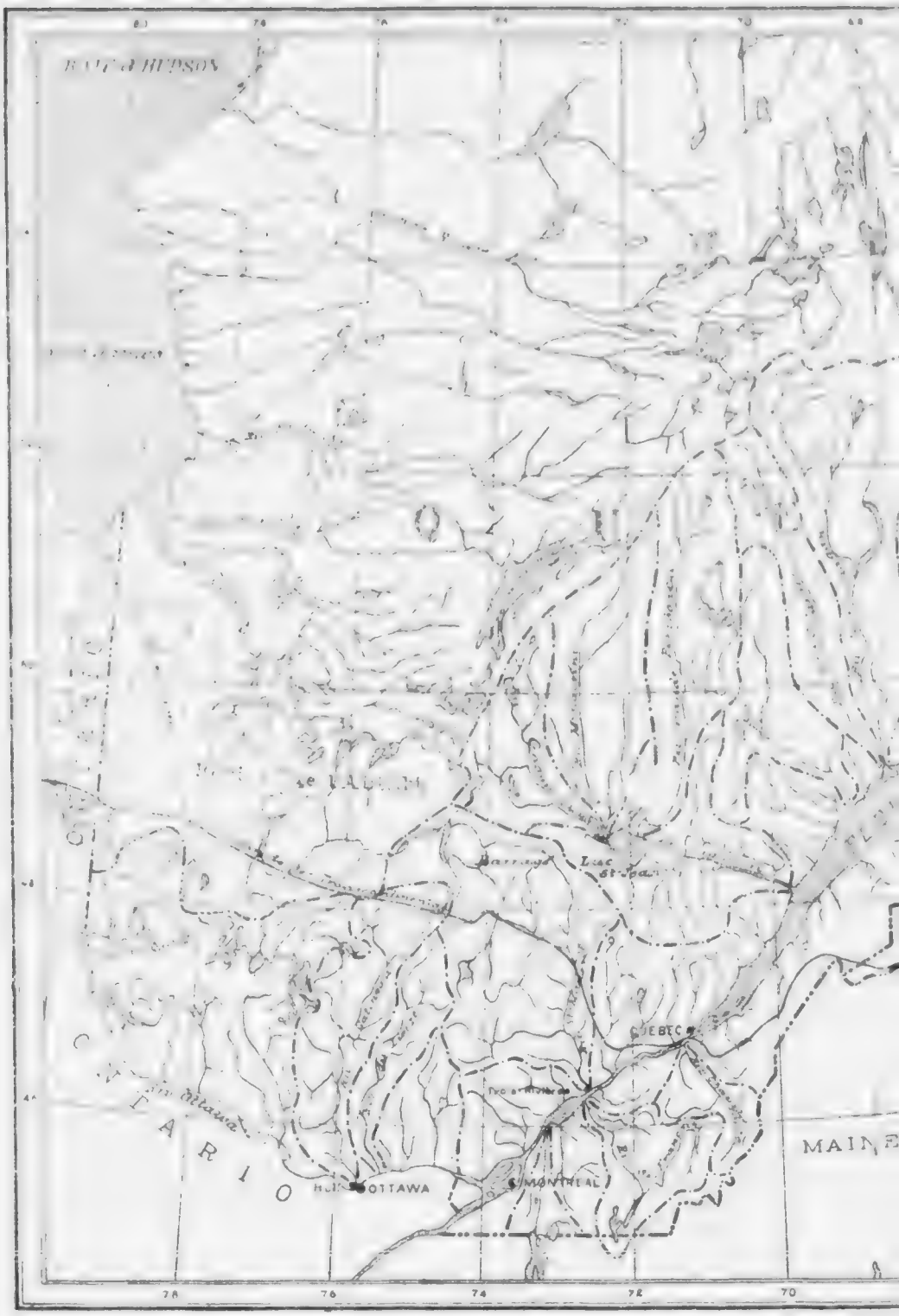
A certain number of secondary rivers falling into the St-Lawrence from the St-Maurice to the mouth of the Ottawa will now be left aside, and only the latter and its tributaries will be dealt with. It may, however, be stated that there are a number of local industries doing a good business on those small rivers.

River Ottawa. This is the most important of the tributaries of the St-Lawrence. Its mouth is in the lake of Two Mountains, at the head of the island of Montreal. Its minimum flow is 20,000 cubic feet per second while in the freshets it is more than 240,000 cubic feet. The variation is usually from 1 to 10 or 12. This river has been minutely studied by the engineers working on the Georgian Bay Canal project, and the results of their studies have been given at length in the various reports.

Its water-powers are barely utilized although a good many grants have already been given. There are several reasons for this: for instance, the fact that this river is the boundary between the provinces of Quebec and Ontario, obliges applicants to negotiate for grants with both Governments. Moreover, as the river is navigable, the Federal Government also inter-



General View of the Shawinigan mills, on the Saint Maurice


BAY & HUDSON
Lac St. Jean
QUEBEC
Trois Rivières
MONTREAL
OTTAWA
ONTARIO
MAINE
78
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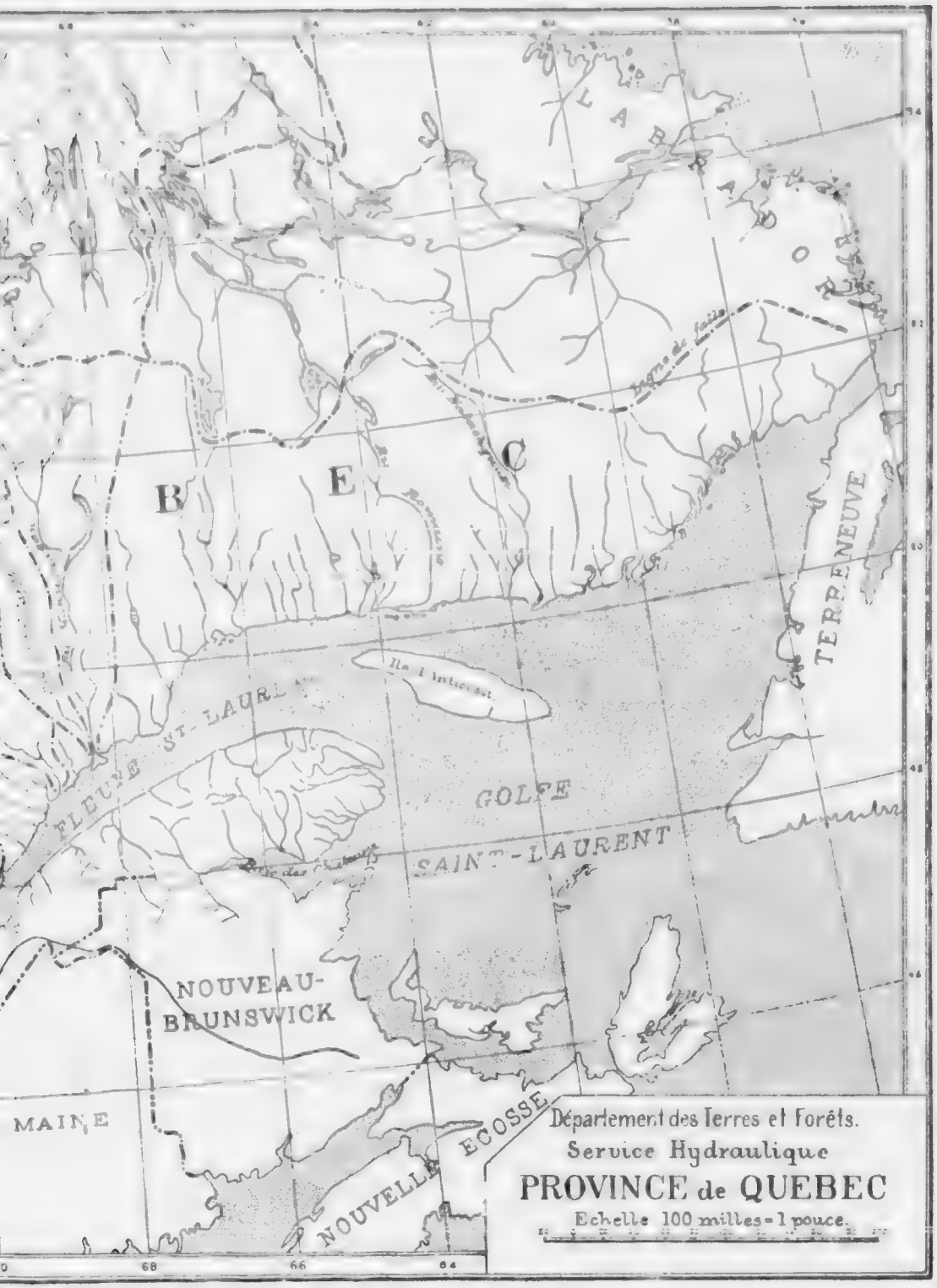

LABRADOR
QUEBEC
TERRE-NEUVE
Ile d'Anticosti
FLEUVE ST-LAURENT
GOLFE
SAINT-LAURENT
NOUVEAU-BRUNSWICK
MAINE
NOUVELLE ECOSSE
Département des Terres et Forêts.
Service Hydraulique
PROVINCE de QUEBEC
Echelle 100 milles = 1 pouce.
68
66
64

Dam for the diversion of the Great Macaroni at Shewinigan.

The Great Macaroni dam at Shewinigan, seen closer.

The Shawinigan-Montreal transmission line.

View of Grand Mère on Saint Maurice river, before the complete damming of the river.

venes, which means that every project for a water-power plant must provide for locks for the passage of vessels; again the expropriation of bordering lands, which would be flooded by raising the water level or which would be required for making navigable canals, would entail considerable expense. All these are so many obstacles which have hitherto contributed to prevent industrial development on this river.

And yet, the storage dams already built by the Federal Government on lakes Témiscamingue, Kipawa, Des Quinze and others under consideration, tend to increase the minimum flow and to prevent excessive flood waters and they should be an incentive to industrial development. If it became urgent, there is reason to believe that the Federal Government and the two Provincial Governments would come to an agreement to facilitate the exploitation of those resources. Some transactions of the kind, in connection with the Des Quinze river, an extension of the Ottawa entirely in Quebec territory, have taken place between the Federal Government and the Government of the province of Quebec.

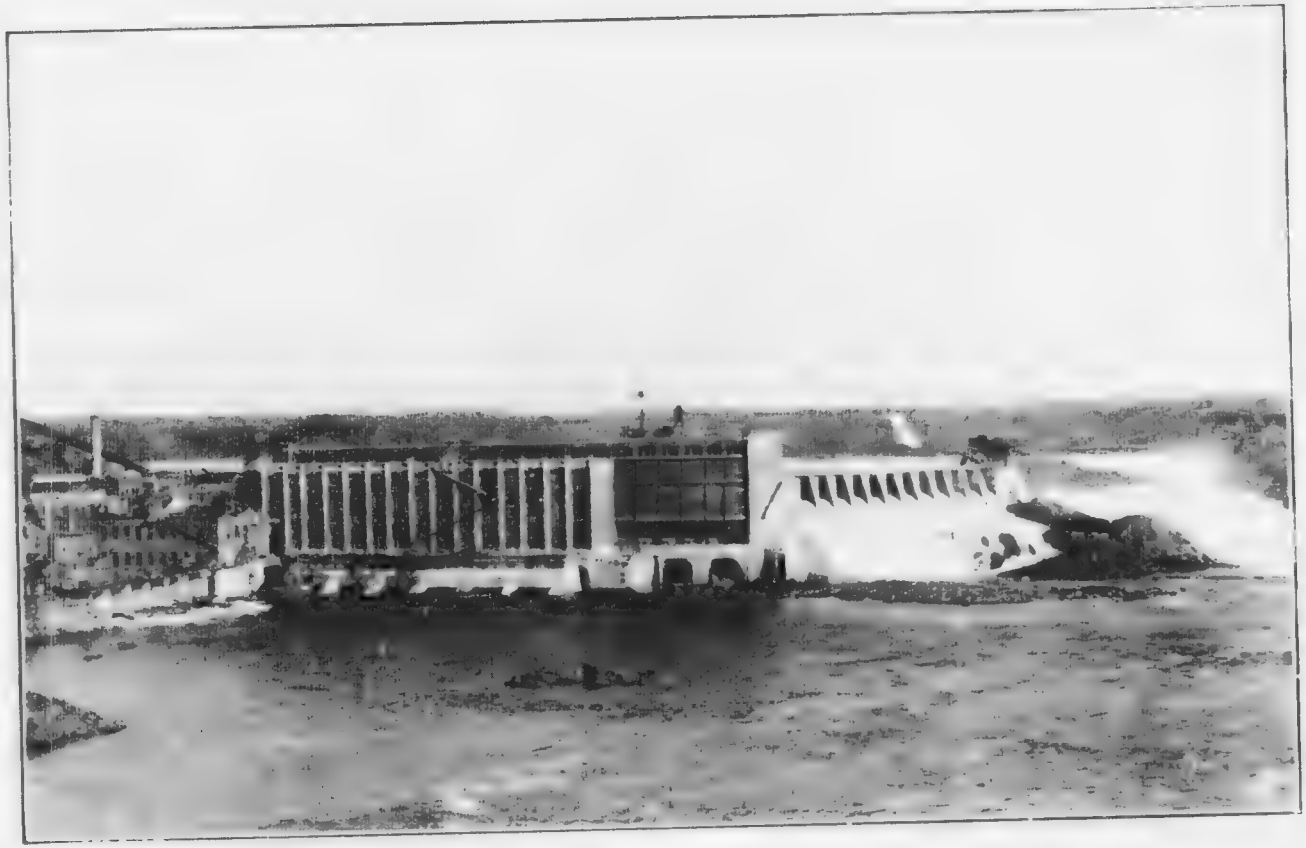
To return to the water-powers of the Ottawa, we may briefly mention the sites which have attracted most attention during the past six years. They are as follows:

The Carillon rapids, 35 miles from Montreal as the crow flies. The difference of level here is rather slight (13 feet); but a dam 40 feet high could be built which would drown out some rapids above. With such a dam, benefiting by the flow regulated to 40,000 cubic feet through the dams above mentioned, 150,000 H.P. could be produced. However, as those dams do not yet work satisfactorily, that flow is far from being obtained.

The second site which has attracted much interest is that of the Chats rapids, 25 miles west of Ottawa city as the crow flies. There also is a very considerable power (48 feet difference of level and over 100,000 H.P. with the flow regulated). But the obstacles mentioned above are complicated here by previous grants of both Provincial Governments which would have first to be cancelled. (1)

River Des Quinze.— It is really an extension of the Ottawa. It connects lake Des Quinze with lake Témiscamingue. All the falls on it are conceded except one, but none have been developed as yet. The total energy to be obtained from its rapids is estimated at 90,000 H.P. at low water. Here, at the head of the rapids, is the second storage dam built by the Federal Government.

(1) For further details regarding this river, the reader is referred to the Federal Government's report on the Georgian Bay Canal.



Works at Grand'Mère, on the Saint-Maurice after the completion of dam.

Sorting of logs on Saint-Maurice river.

The Saint Maurice river south of La Tuque.

The catchment area at this place is 10,000 square miles and the superficies of the reservoir itself about 400 square miles.

There has been no serious question of developing any other power above the Des Quinze river, although the owners of mines in the neighbourhood of lake Preissac (Kewaganna) where molybdenite ores have been found, have applied for available falls in the vicinity.

Rivers Du Lièvre, Gatineau, Coulonge. We cannot conclude this chapter without at least mentioning some tributaries of the Ottawa which might be developed to advantage. They are: the Lievre (basin 4,000 square miles); the Gatineau (basin 9,130 square miles); the Coulonge (basin 1,820 square miles) etc.

River Kipawa. We must also mention the Kipawa river which falls into lake Témiscamingue and offers fine sites. Its flow is improved by the lake Kipawa dams.

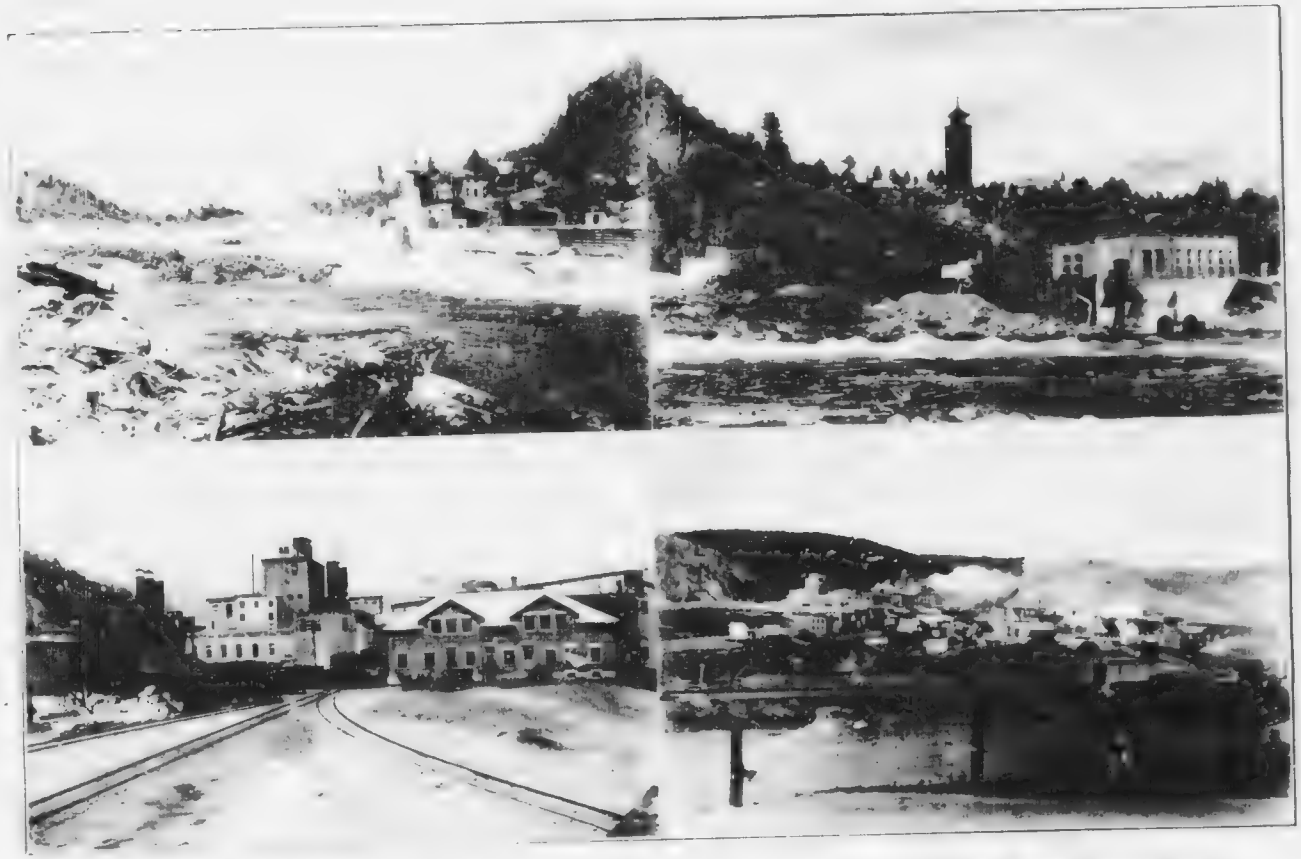
LAKE SAINT-JOHN REGION. (i.e. Lake Saint-Jean).

The area of lake Saint-John is 350 square miles at low water and nearly 400 miles at high water stage. It is embedded in a depression in the Laurentian Plateau. The riparian hills draw near to it on the south side and narrow its drainage basin; but, to the north, on the contrary, the watershed spreads out and is more than 200 miles wide.

This region abounds in water-falls: nearly all the tributary rivers offer advantageous sites, particularly the Chamouchouane, Mistassini, Mistassibi, Péribonca, Ouiatchouane and Métabetchouane. There are already establishments on the Ouiatchouane and Mistassibi.

River Chamouchouane. — This river is one of the three principal tributaries of the lake into which it falls on the west side directly opposite the Grande-Décharge or main outlet. The

1. See report of the Department of Lands and Forests (1910).



1. Falls of the Saint Maurice, at La Tuque.
2. Hydraulic plant of the Brown Corporation.
3. Brown Corporation pulpmill.
4. General view of La Tuque.

La Tuque Falls

Log-driving on Gordon Creek

Gordon Creek, outlet of Lake Kipawa

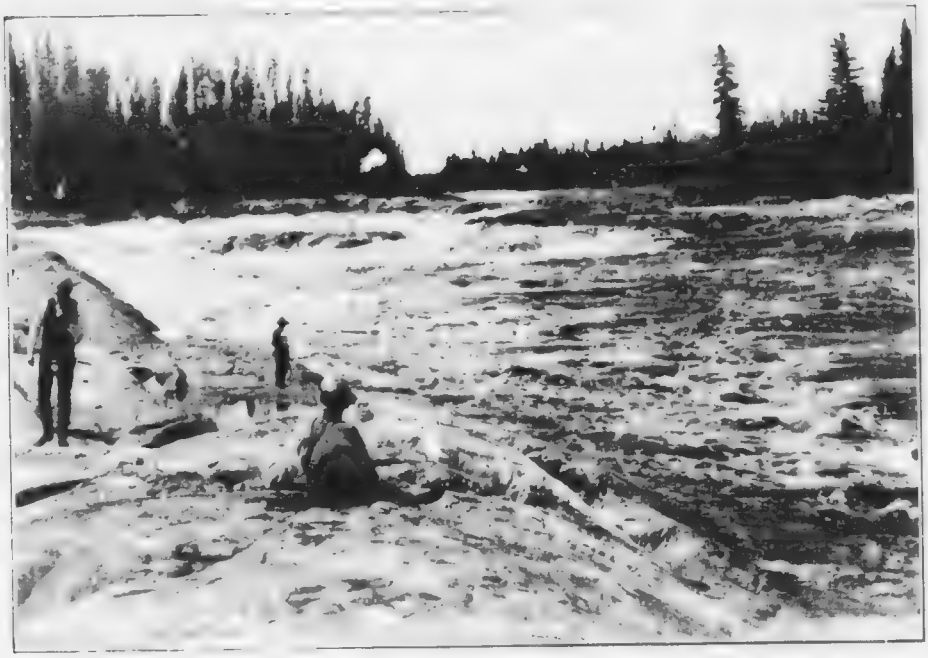
[illegible] about 5,500 square miles, [illegible] length about 100 miles. It is in the form of lake Mistassini, [illegible] 1,500 [illegible]. The important village of St. [illegible] the [illegible] mouth at the head of the [illegible]. There [illegible] Chute au Sauvage, a Pouce falls, [illegible] to span the river near there. The [illegible] energy [illegible] estimated at 5,000 H.P., the [illegible] being 20 feet. The [illegible] of this stream may be put down at 1,500 [illegible].

Saguenay river.

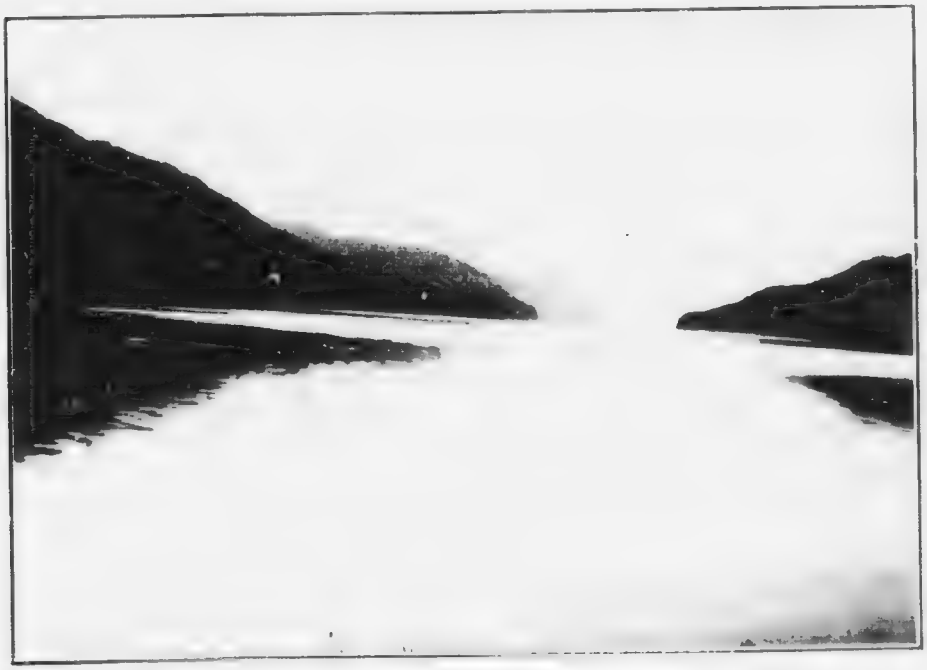
There are other falls and rapids above, along the course of the river, the principal ones being as follows: the falls of the Petit Portage, 5 d'Ours, 20 miles from the mouth of the river, and 25 miles in a straight line from the railway terminus at Roberval. The difference of level of the two [illegible] is 39 feet and the gross power has been estimated at about 11,500 H.P. for a flow of 2,600 cubic feet per second.

Then come various rapids and, above them, the Chaudière falls, about 37 miles from the lake, the total difference in level of which is 112 feet and the gross energy 24,000 H.P.

Logs from the surrounding forests are piled on the banks of frozen rivers and lakes, to be driven to destination the following spring.



Mistassini river, tributary of lake Saint-Jean



Lake Tchitogama. Flows into the Grande-Péribonca river.

River Mistassini. This is the second in importance of the large tributaries of the lake. Its drainage basin is estimated at 7,800 square miles. It is navigable for a distance of 19 miles, from its mouth to its confluence with the Rivière-au-Foin or Mistassibi, where the first cascades appear.

The first fall is 19 feet high and is followed by a second of equal height, 1200 feet further up. The combined energy of the two is estimated at 8,500 H.P.

There are many other falls above the first two, which it is not necessary to treat of here. The first falls on the Rivière au-Foin, an important tributary of the Mistassini, must however be mentioned as they are near the confluence. They are called the Chutes-des-Pères owing to their proximity to the Trappists' establishment. The cascade is some 300 feet in length and 45 feet high. Its energy during the six summer months is estimated at 25,000 H.P. and probably drops one half in winter.

River Péribonca. The most important tributary of the lake. Its basin is estimated at 12,000 square miles and its length at nearly 250 miles. It is navigable for the first 12 miles, to Honfleur. From that point, a series of falls begins which would have to be concentrated at various places, by damming the river, to obtain energy of sufficient importance. Thus, the Chute-à-Caron, 15 miles from the mouth, with the declivity of the Willie rapids in addition, would give a head of from 20 to 25 feet and an energy of 10,000 H.P.; the Bonhomme falls, with the addition of the Islet rapids and of a portion of the Chute-du-Diable, would give from 30 to 40 feet; lastly, the McLeod falls, with the addition of the Barnabé rapids, would give a total height of 35 feet and an energy of 16,000 H.P.

The regulation of the flow of this river by holding back the flood water in the upper reaches, would have the twofold advantage of increasing the value of its water-powers as well as of those of the Grande-Décharge. The Quebec Streams Commission has this study on its programme and is to report at an early date.

Rivers Ouiatchouane Métabetchouane. These two rivers are secondary tributaries, but, nevertheless, have advantageous sites for water-power development. The celebrated falls on the former, over 200 feet high, are already developed for an energy of 4,500 H.P. which will soon be increased to 7,000 H.P. through the storage of flood waters in Lac-des-Commissaires.

McLeod falls, Grande-Péribonca river

Métabetchouane river, near its mouth in Lake Saint-Jean.

The Métabetchouane also has various interesting falls, among which the following may be mentioned:

The Lamartine falls, in range III, a group consisting of eleven cas-

Pulp mill on Chicoutimi river

cades with a total difference in level of 170 feet, capable of producing about 13,000 H.P. at medium flow and about one half less at low water stage;

The Chute-à-l'Epouvante with a height of about 50 feet, and a capacity of 2,000 H.P.;

The Cascades, 17½ miles from lake St-John, with a height of 32 feet and a capacity of about 1,300 H.P.;

Lastly, the Planche falls, 19 miles from the mouth, 34 feet high at low water stage and a capacity of about 1,500 H.P. on an average.

Cyriac river, near its mouth in lake Kenogami.

Log-jam forming an artificial dam, near Kenogami.

Rivers au Sable, Chicoutimi, Shipshaw. Several tributaries also have falls of importance among which the Au Sable, Chicoutimi and Shipshaw may be mentioned. The large pulp and paper mills on the two former constitute the principal industries of that region.

Grande-Décharge. This is the name given to the outlet of lake St-John which falls into the Saguenay. With the exception of the St-Lawrence rapids, the most important water-powers in the whole province, as a group, are those of the Grande-Décharge; but the latter have this advantage over the former that their development does not impede navigation. The total difference of level, from sea level, that is, that of the Saguenay river, to the lake is 315 feet. The whole of such declivity could be utilized by means of two dams, 200 and 115 feet in height respectively.

The drainage basin at this point is about 30,000 square miles and the minimum flow, 13,000 cubic feet per second. Thanks, however, to the splendid reservoir formed by lake St-John, that flow may be markedly increased. The studies so far made clearly show the possibility of developing a permanent energy of 600,000 H.P. and much more for intermittent requirements.

Besides this group, it would be easy to develop several hundred horse-power in the tributaries of the lake within a radius of less than 25 miles.

Subject to revision, the minimum flow of the discharge of the lake may be made up, as follows, from its tributaries:

Péribonca	5,000	cubic feet per second.
Mistassini.....	2,000	" " " "
Mistassibi.....	2,000	" " " "
Chamouchouane....	1,700	" " " "
Other tributaries	3,000	" " " "
	13,700	

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VI

THE ABITIBI REGION.

ADJOINING THE TRANSCONTINENTAL RAILWAY.

The region commonly known as "Abitibi" comprises the great plain about a hundred miles long extending from the Bell river to the Ontario boundary, that is to say, lake Abitibi. As the soil seems very suitable for

The Grande-Décharge, lake Saint-Jean.

cultivation a strong colonization movement has been organized toward that direction since the Transcontinental has been built. The region is characterized by the absence of hills; consequently, there are nowhere such important water-powers as those at which we have just cast a rapid glance. Nevertheless, the Government of the Province of Quebec has had the principal ones examined on the Mégiscane, Bell, Harricana, Kinojevis and La Sarre [illegible] Also [illegible] machines from 500 to 2,000 H.P.

All these rivers flow into James Bay, with the exception of the Kinojevis which runs towards the Ottawa.

VII

THE BASIN OF JAMES BAY, AND OF UNGAVA OR NEW QUEBEC

This region of the Province of Quebec covers a large area, larger than that of all the parts spoken of above together. It is [illegible] unknown and is inhabited solely by trappers in the employ of the Hudson Bay Company, in connection with the fur trade.

So far, the Quebec Government has had only preliminary explorations made of the south-eastern slope of James Bay, but the greater portion of Ungava has already been explored by the Ottawa Geological Survey. Information of some value has also been furnished by the missionaries and trappers.

The Laurentian plateau covers the greater portion of that territory whose altitude, in the interior, varies between 1,000 and 2,000 feet; the mean altitude on the north-western slope is 500 feet.

Along the whole of the eastern coast of James Bay, from the boundary between Ontario and Quebec, and Cape Jones forming the northern point of James Bay, the altitude drops from 0 to 100 feet on an average width of 50 miles.

In the portion of the plateau extending north of Cape Jones and whose altitude varies between 500 and 1,000 feet, the falls on the rivers there are comparatively near the coast. The discharge of those rivers is but little known, but it suffices to consider the area of the drainage basin of some of them to have an idea of the run off.

The length of the following rivers varies between 200 and 600 miles:

Harricana,	Basin	of 11,000	square	miles
Nottaway,	"	" 26,000	"	"
Broadback	"	" 9,000	"	"
Rupert,	"	" 16,000	"	"
East Main	"	" 25,000	"	"
Big,	"	" 28,000	"	"
Great Whale	"	" 22,100	"	"
Koksoak,	"	" 67,600	"	"
Whale	"	" 11,900	"	"
George,	"	" 19,400	"	"
Hamilton	"	" 60,000	"	"

The great fall of the Hamilton (latitude 53°30', longitude 64°30' west) is rated to be 300 feet high. But, according to W. Thibaudeau, C.E. who has explored this region in 1914, a head of 960 feet and a capacity exceeding one million horse-power could be obtained by means of a dam and diversion canal through a chain of communicating lakes in the vicinity.

According to the reports of the surveys in those regions, there are a great many falls whose heights vary between 25 and 75 feet. Few persons have hitherto taken any interest in the waters of that isolated and unknown region; an application, however, for the purchase of a lot on the Nastapoca is under consideration. The energy to be produced at that spot is estimated at over 75,000 H.P., and it is proposed to use a portion of it in treating iron ores found in abundance on an island some distance from there.

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Conclusion. From the foregoing, it may be seen that the Province of Quebec is well provided with water-powers, but that most of the falls are not of great height.

It should also be observed that the sites where considerable energy (over 50,000 H.P.) can be produced, and still in a natural state, are remarkably situated for supplying the wants of the principal cities. Thus, for the vicinity of the city of Ottawa, we find the Chats falls and other rapids of the Ottawa river; for Montreal, besides the sources of energy now in use, the rapids of the St-Lawrence at Coteau, Les Cèdres, and also the Sault-Saint-Louis; for Trois-Rivières and Quebec, the water-powers of the river St-Maurice, regulated by the largest reservoir in Canada, at La Loutre; for the Saguenay and Chicoutimi region, the rapids of the Grande-Décharge; lastly, for the Lower St-Lawrence, the falls of the Manicouagan and of the river Aux Outardes.

The south shore of the St-Lawrence is not so well provided, but it may be said that for the more densely populated regions, that is to say,

the Eastern Townships, the St-François river, when regulated, will suffice for the demand, for a good many years.

The advantages of the lake Saint-Jean region and, particularly those of the Grande-Décharge should be especially emphasized. The natural conditions there are remarkable; the available undeveloped power is enormous; ocean navigation is possible almost as far as the spot where the works could be erected; there is no lack of labour and a railway connects the district with Quebec and Montreal, as well as a steamer line.

Lastly, we would say that the Quebec Streams Commission, acting under the jurisdiction of the Provincial Government, has taken in hand the improving of the regimen of rivers on which industries are established. Great advantages are anticipated from this policy and everything tends to show that, within the next decade, the work of this body will produce all the good results expected from it.

CHAPTER VIII.

MODE OF APPLICATION TO OBTAIN AUTHORIZATION FOR THE DEVELOPMENT OF WATER POWERS IN THE PROVINCE OF QUEBEC.

To obtain authorization for the utilization of a water power in the Province of Quebec, application must be made to the Honourable Minister of Lands and Forests, accompanied by a statement setting forth the information mentioned below.

But, before indicating the conditions on which water powers are leased or granted, it is necessary to briefly explain within what limits the Administration is permitted by jurisprudence to act, and why it is sometimes necessary to obtain two titles: one from the Crown and the other from a private individual, for the same property.

Under present legislation, the rivers of this Province are considered as being of two classes.

1. Those which are navigable and floatable; 2. Those which are neither navigable nor floatable.

The beds of navigable and floatable rivers are vested in the Crown, as represented by the Provincial Government; and therefore the water powers form part of the public domain.

The beds of non-navigable and non-floatable rivers are either private property of form part of the public domain; they are private property when the lands bordering them have been granted by the Crown previous to the year 1884; on the contrary, they remain part of the Crown domain, as in the case of navigable rivers, if the lands bordering them have been sold since that date, because, under an act of the Legislature, reservation in favour of the Crown is always made since that date, of a strip of land

three chains wide on the banks of non-navigable and non-floatable rivers. From this it will be seen that in the case of non-navigable and non-floatable rivers, the fact of being a riparian owner makes one also the owner of the bed of the river and of the water power thereon.

Now, the character of a navigable river not being defined with strict precision, the consequence is that differences of opinion sometimes arise and, in order to avoid litigation, it may be to the advantage of the purchaser to obtain the Government's rights on the one hand, and those of the riparian owner, on the other. Such cases evidently occur only in the older parts of the Province which have long been settled; the tittle from the Crown is sufficient everywhere else.

Therefore, in order to be able to utilize a water fall for any purpose whatever, when there is any doubt as to the character of the rivers, the applicant should, first of all, send a petition to the Department of Lands and Forests, with a statement setting forth:

a) His name, address and occupation.

b) A description of the lake or river from which the water is to be used, and stating in what range, township and county.

c) The height of the fall or rapid of such lake or river, at high and low stages, with corresponding discharger of water per second in cubic feet.

d) A plan of the river of lake, showing location of falls or rapids, and a sketch-plan of proposed works.

If the applicant be an incorporated company, the statement shall, in addition to the foregoing information, set forth:

a) The name of the company.

d) The names of the directors and officers of the company, and their places of residence.

On receipt of the foregoing information, and after considering the same, the Minister of Lands and Forests will state the conditions on which the water power may be leased or granted, if he approves of the nature of the work to be carried out.

Such conditions usually depend on the importance of the water powers and on their geographical situation.

As a rule, two alternatives are taken into consideration. If the water power cannot develop more than 200 horse-power, the Government sells, for a fixed price, a lot in the river bed with the lots of land on the banks if owning any, including the power that can be developed. This transaction may be made final by the granting of Letters-Patent and, when this is done, the grantee becomes entirely independent of the Government.

When the capacity exceeds 200 horse-power, the concession generally takes the form of an emphyteutic lease. The conditions of such leases are, as much as possible, similar and about as follows:

1.—Duration of the lease, from 25 to 99 years, according to the importance of the water power and to the amount of capital required for its development.

2. Payment of a yearly rental which does not vary during the term of the lease, for the land granted, counting from the date when the contract is signed.

3. An additional yearly charge of from 10 to 35 cents per horse-power developed, according to the geographical situation of the site of the water power; such charge being payable from the time the power is produced.

4. The above charge is subject to revision every twenty-one years counting from the signing of the contract.

5. Delay of two years for beginning works and two further years for producing power.

6. The lessee to make a deposit in money or in securities as a guarantee of good faith of the carrying out of the contract. Such deposit may be forfeited if the conditions are not fulfilled; but it may be repaid after a certain time, in the contrary case.

7. Lastly, the grantee must submit plans of his works, mills, etc., to the Department previous to their installation, and when such installation is completed, he must keep the Department informed of the quantity of power produced.

Of course the Government retains the right to verify the fulfilment of these conditions and, should they not be fulfilled, the lease may be cancelled.

When authorization is obtained by a lease from the Provincial Government, the grantee may proceed with his works on condition that he shall not interfere with navigation, if any is really carried on; for, in that case, the plans must be approved by the Federal Government whose duty is to specially protect such navigation, and, consequently, to prevent the erection of anything that may impede it.

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